

Thermodynamics: The fundamental definition and concept, the zeroth and first law. Work, heat, energy and enthalpies. The relation between C_v and C_p . Second law: entropy, free energy (the Helmholtz and Gibbs) and chemical potential. Change of Phase: Clapeyron-Clausius equation. Third law. Chemical equilibrium, Chemical kinetics: The rate of reaction, elementary reaction and chain reaction. Electrochemistry: Conductance of solutions, equivalent and molar conductivities and its variation with concentration. Kohlrausch's law-ionic mobilities, Transference number of ions. Activities in electrolytic solutions, application of Debye-Huckel theory. The Walden's rule. Debye-Huckel-Onsager treatment. Electrochemical cells, Nernst equation. Application of EMF measurements. Liquid junction potential, commercial cells – the primary and secondary cells. Fuel cells. Polarisation and overvoltage.

The periodic table of elements, shapes of inorganic compounds, chemistry of materials. Coordination compounds: ligand, nomenclature, isomerism, stereochemistry, valence bond, crystal field and molecular orbital theories. Bioinorganic chemistry and organometallic chemistry.

Stereo and regio-chemistry of organic compounds, conformers. Bioorganic chemistry: amino acids, peptides, proteins, enzymes, carbohydrates, nucleic acids and lipids. Modern techniques in structural elucidation of compounds (UV – Vis, IR, NMR). Solid phase synthesis and combinatorial chemistry. Green chemical processes.

Texts:

1. P. W. Atkins, Physical Chemistry, ELBS, 5th Ed, 1994.
2. J. O'M. Bockris and A. K. N. Reddy, Modern Electrochemistry, Volume 1 and 2, Kluwer Academic, 2000.
3. K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India, 2nd Ed, 1986.
4. F. A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, Wiley Eastern Ltd, New Delhi, 3rd Ed, 1972 (reprint in 1998).
5. D. J. Shriver, P. W. Atkins and C. H. Langford, Inorganic Chemistry, ELBS, 2nd Ed, 1994.
6. S. H. Pine, Organic Chemistry, McGraw Hill, 5th Ed, 1987

Reference:

1. I. A. Levine, Physical Chemistry, McGraw Hill, 4th Ed, 1995.
2. J. E. Huheey, E. A. Keiter and R. L. Keiter, Inorganic Chemistry: Principle, structure and reactivity, Harper Collins, 4th Ed, 1993.
3. L. G. Wade Jr., Organic Chemistry, Prentice Hall, 1987.

Estimation of metal ion: Determination of total hardness of water by EDTA titration. Experiments based on chromatography: Identification of a mixture containing two organic compounds by TLC. Experiments based on pH metry.: Determination of dissociation constant of weak acids by pH meter. Experiments based on conductivity measurement: Determination of amount of HCl by conductometric titration with NaOH. Synthesis and characterization of inorganic complexes: e. g. $Mn(acac)_3$, $Fe(acac)_3$, *cis*-bis(glycinato)copper(II) monohydrate and their characterization by m. p. IR etc. Synthesis and characterization of organic compounds: e.g. *p*-nitroacetanilide, aspirin. Kinetics: Acid catalysed hydrolysis of methylacetate. Verification of Bees-

Lamberts law and determination of amount of iron present in a supplied solution. Experiments based on electrogravimetry and electroplating. Experiments based on magnetometry. In addition to these there will be a lecture on environmental awareness and on errors in data analysis.

EE101

Electrical Sciences

(3-1-0: 8)

Circuit Analysis Techniques, Circuit elements, Simple RL and RC Circuits, Kirchoff's law, Nodal Analysis, Mesh Analysis, Linearity and Superposition, Source Transformations, Thevenin's and Norton's Theorems, Time Domain Response of RC, RL and RLC circuits, Sinusoidal Forcing Function, Phasor Relationship for R, L and C, Impedance and Admittance.

Semiconductor Diode, Zener Diode, Rectifier Circuits, Clipper, Clamper, Bipolar Junction Transistors, Transistor Biasing, Transistor Small Signal Analysis, Transistor Amplifier, Operational Amplifiers, Op-amp Equivalent Circuit, Practical Op-amp Circuits, DC Offset, Constant Gain Multiplier, Voltage Summing, Voltage Buffer, Controlled Sources, Instrumentation Circuits, Active Filters and Oscillators.

Number Systems, Logic Gates, Boolean Theorem, Algebraic Simplification, K-map, Combinatorial Circuits, Encoder, Decoder, Combinatorial Circuit Design, Introduction to Sequential Circuits.

Magnetic Circuits, Mutually Coupled Circuits, Transformers, Equivalent Circuit and Performance, Analysis of Three-Phase Circuits, Electromechanical Energy Conversion, Introduction to Rotating Machines.

Texts/References

1. C. K. Alexander, M. N. O. Sadiku, *Fundamentals of Electric Circuits*, 3rd Edition, McGraw-Hill, 2008.
2. W. H. Hayt and J. E. Kemmerly, *Engineering Circuit Analysis*, McGraw-Hill, 1993.
3. Donald A Neamen, *Electronic Circuits; analysis and Design*, 3rd Edition, Tata McGraw-Hill Publishing Company Limited.
4. Adel S. Sedra, Kenneth C. Smith, *Microelectronic Circuits*, 5th Edition, Oxford University Press, 2004.
5. R. L. Boylestad and L. Nashelsky, *Electronic Devices and Circuit Theory*, 6th Edition, PHI, 2001.
6. M. M. Mano, M. D. Ciletti, *Digital Design*, 4th Edition, Pearson Education, 2008.
7. Floyd, Jain, [*Digital Fundamentals*](#), 8th Edition, Pearson.
8. A. E. Fitzgerald, C. Kingsley Jr., S. D. Umans, *Electric Machinery*, 6th Edition, Tata McGraw-Hill, 2003.
9. D. P. Kothari, I. J. Nagrath, *Electric Machines*, 3rd Edition, McGraw-Hill, 2004.

MA 101

Mathematics I

(3 1 0 8)

Properties of real numbers. Sequences of real numbers, monotone sequences, Cauchy sequences, divergent sequences. Series of real numbers, Cauchy's criterion, tests for convergence. Limits of functions, continuous functions, uniform continuity, monotone and inverse functions. Differentiable functions, Rolle's theorem, mean value theorems and Taylor's theorem, power series. Riemann integration, fundamental theorem of integral calculus, improper integrals. Application to length, area, volume, surface area of revolution. Vector functions of

one variable and their derivatives. Functions of several variables, partial derivatives, chain rule, gradient and directional derivative.

Tangent planes and normals. Maxima, minima, saddle points, Lagrange multipliers, exact differentials. Repeated and multiple integrals with application to volume, surface area, moments of inertia. Change of variables. Vector fields, line and surface integrals. Green's, Gauss' and Stokes' theorems and their applications.

Text Books:

1. G. B. Thomas and R. L. Finney, *Calculus and Analytic Geometry*, 6th Ed/ 9th Ed, Narosa/ Addison Wesley/ Pearson, 1985/ 1996.
2. T. M. Apostol, *Calculus*, Volume I, 2nd Ed, Wiley, 1967.
3. T. M. Apostol, *Calculus*, Volume II, 2nd Ed, Wiley, 1969.

References:

1. R. G. Bartle and D. R. Sherbert, *Introduction to Real Analysis*, 5th Ed, Wiley, 1999.
2. J. Stewart, *Calculus: Early Transcendentals*, 5th Ed, Thomas Learning (Brooks/ Cole), Indian Reprint, 2003.

ME110

Workshop – I

(0 0 3 3)

Carpentry: Introduction to wood working, Marking and Measuring Tools-rule, try square, marking gauge, mortise gauge etc., Cutting Tools-rip saw, tenon saw, firmer chisel, mortise chisel, iron jack plane, wooden jack plane etc., Drilling Tools-braces, drill bits etc., Striking Tools-hammers, mallet etc., Holding Tools-bench vice, G-cramp etc., Miscellaneous Tools- rasps, files, screw driver, pincer etc.; Operations-marking, sawing, planning, chiseling, boring, grooving etc., Joints- Corner joints, Tenon and Mortise joint, Bridle cross-joint.

Fitting: Introduction to fitting, Tools-bench vice, hammers, chisels, files-flat file, square file, half round file, round file, knife edge file, scrapers, hacksaws, try squares, drill machine, drill bits, taps, dies etc, Operations-chipping, filing, scrapping, sawing, marking, drilling, tapping, dieing etc.;

Sheet Metal Working: Introduction to sheet metal work; GI sheets, aluminium, tin plate, copper, brass etc, Toolssteel rule, vernier calipers, micrometer, sheet metal gauge etc., scribe, divider, punches, chisels, hammers, snips, pliers, stakes, rivets etc., Operations-shearing, bending, drawing, squeezing etc.

Pattern making and Foundry: Introduction to pattern making, moulding and foundry practice. Pattern material-wood, cast iron, brass, aluminium, waxes etc., different types of patterns, core-boxes, core prints, hand tools-shovel, riddle, rammer, trowel, slick, lifter, sprue pin, bellow, mallet, vent rod, pouring weights etc., moulding sands-green sand, dry sand, loam sand, facing sand etc., grain shape and size, properties of moulding sand, sand preparation and testing etc., casting- permanent mould casting, centrifugal casting etc.

Text and Reference books:

1. Hajra Choudhury, Hazra Choudhary and Nirjhar Roy, 2007, *Elements of Workshop Technology*, vol. I, Media promoters and Publishers Pvt. Ltd.
2. W A J Chapman, *Workshop Technology*, 1998, Part -1, 1st South Asian Edition, Viva Book Pvt Ltd.
3. P.N. Rao, 2009, *Manufacturing Technology*, Vol.1, 3rd Ed., Tata McGraw Hill Publishing Company.
4. Kaushish J.P., *Manufacturing Processes*, 2008, Prentice Hall India.

CE111

Engineering Drawing

(2 0 3 7)

Geometrical construction of simple plane figure:

Bisecting the line, draw perpendicular, parallel line, bisect angle, trisect angle, construct equatorial triangle, square, polygon, inscribed circle

Free hand sketching: prerequisites for freehand sketching, sketching of regular and irregular figures.

Drawing scales: Engineering scale, graphical scale, plane scale, diagonal scale, comparative scale, scale of chord

Orthographic projection: Principle of projection, method of projection, orthographic projection, plane of projection, first angle of projection, third angle of projection, reference line

Projection of points, lines and plane: A point is situated in the first quadrant, point is situated in the second quadrant, point is situated in the third quadrant, point is situated in the fourth quadrant, projection of line parallel to both the plane, line contained by one or both the plane, line perpendicular to one of the plane, line inclined to one plane and parallel to other, line inclined to both the plane, true length of line

Missing views: Drawing of missing front view of a solid, missing top view of solids, missing side view of solids

Orthographic projection of simple solid: Introduction, types of solid, projection of solid when axis perpendicular to HP, axis perpendicular to VP, axis parallel to both HP and VP, axis inclined to both HP and VP

Text/Reference books:

1. B. Agrawal and CM Agrawal, Engineering Drawing, Tata McGraw-Hill Publishing Company Limited, 2008.
2. D. A. Jolhe, Engineering Drawing, Tata McGraw-Hill Publishing Company Limited, 2006.
3. K Venugopal, Engineering Drawing and Graphics, 2nd ed, New Age International, 1994.

HS103

Communicative English for Engineers

(3-0-0-6)

Essays

- Freedom by George Bernard Shaw
- Student Mobs by J.B. Priestley

Short Stories

- The Three Dancing Goats- A Folk Tale (Anonymous)
- The Fortune Teller by Karel Capek
- Grief by Anton Chekov

One-Act Play

- Refund by Fritz Karinthy

Poems

- Night of the Scorpion by Nissim Ezekiel
- Porphyria's Lover by Robert Browning

Texts:

1. 'Essays, Short Stories and One-Act Plays' ed. By R.K. Kaushik and S.C. Bhatia, Oxford University Press, 1975

References:

2. Krishna Mohan and Meera Banerji, Developing Communication Skills, Macmillan India Ltd.
 3. John Eastwood, Oxford Practice Grammar, Oxford, New Delhi, 2005
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Classical Mechanics: Position, velocity and acceleration vectors in plane polar coordinate. Newton's laws of motion. Fundamental forces. Contact forces. System of Particles. Conservation of momentum. Work-energy theorem. Line integral of a vector field. Conservative forces. Gradient of a scalar field. Potential energy and equilibrium. Conservation of energy. Angular momentum. Rotation about fixed axis. Torque. Motion involving translation and rotation. Vector nature of angular velocity and angular momentum. The Gyroscope. Pseudo forces. Rotating frame. Centrifugal and Coriolis forces. Foucault pendulum. Special Theory of Relativity: Result of Michelson-Morley Experiment. Postulates of STR. Galilean transformation. Lorentz transformation. Simultaneity. Length contraction. Time dilation. Relativistic addition of velocities. Quantum Mechanics: Failure of classical concepts. De Broglie's hypothesis. Davison and Germer's experiment. Uncertainty Principle, Wave packets. Phase and Group velocities. Schrodinger equation. Probabilities and Normalization. Expectation values. Eigenvalues and eigenfunctions. Applications in one dimension: Particle in a box, Finite Potential well, Steps and Barriers, Harmonic oscillator.

Texts:

1. D. Kleppner and R. J. Kolenkow, *An Introduction to Mechanics*, Tata McGraw-Hill, New Delhi, 2000.
2. K. Krane, *Modern Physics*, John Wiley, Singapore, 1998.

References:

1. R. P. Feynman, R. B. Leighton and M. Sands, *The Feynman Lecture in Physics*, Vol I, Narosa Publishing House, New Delhi, 1998.
2. J. M. Knudsen and P. G. Hjorth, *Elements of Newtonian Mechanics*, Springer, 1995.
3. R. Resnick, *Introduction to Special Relativity*, John Wiley, Singapore, 2000.
4. A. Beiser, *Concepts of Modern Physics*, Tata McGraw-Hill, New Delhi, 1995